

Iron (Fe) Content in Community Well Water around Mabar Hilir Industrial Area Market 3 Bantenan Medan City in the Perspective of Health and Islamic

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Abstract

Community well water that contains excessive iron (Fe) can have a negative effect on humans who come in contact with or consume the well water, which can irritate the eyes, skin and also cause liver cancer. The purpose of this study was to determine the iron content in community well water around the Mabar Hilir Industrial Area Pasar 3 Bantenan, Medan City. This was an observational research with cross sectional design. The population of this study is the community well water, the number of samples were 10 wells. Sampling was done by purposive sampling and to determine the content of iron (Fe) in well water, samples were taken for testing in the laboratory using the APHA 3120B, 22 nd ed.2012 method. The data analysis used was univariate data analysis. The results of this research showed that it can be seen that out of 10 wells, there are 2 wells that do not qualify as drinking water, namely wells 8 and 9 with the amount of iron content in the well water is 1.913907 and 0.73374 respectively (quality standard = 0.3 mg/L) and 1 well that does not qualify as clean water, namely well 8 with the amount of iron content in the well water is 1.913907 (quality standard = 1.0 mg/L). The drinking water quality standard is based on the regulation of the Indonesian Minister of Health No. 492/Menkes/Per/IV/2010 where the maximum allowable iron (Fe) content is 0.3 mg/L. Clean water quality standard based on the regulation of the Indonesian Minister of Health No. 32 Year 2017 where the maximum allowable iron (Fe) content is 1.0 mg/L.

Keyword: Iron (Fe), Industry, Quality Standard, Water.

INTRODUCTION

Pollution of well water or groundwater can be caused by the presence of metals in the well water or groundwater, either essential or toxic, one of which is iron (Earnestly, 2022); (Sibarani, 2022). Iron is the second most abundant metal in the earth's crust, which amounts to about 5% (Yiannikourides, 2019); (Fatma, 2022); (Fadhilla, 2022). Iron is rarely found in nature because iron ions Fe^{2+} and Fe^{3+} easily combine with compounds containing oxygen, hydroxides, carbonates and sulfides. Iron is most commonly found in nature in its oxide form (Wollschläger, 2018); (Suryani, 2022).

Iron in groundwater will contain up to a few milligrams of iron (II) per litre without discolouration or visible cloudiness in the water when pumped directly from the well, although turbidity and colour may occur as it passes through the piping system at iron levels above 0.05 - 0.1 mg/L (Ghosh, 2020); (Siahaan, 2019). Iron found in well water and then consumed by humans through drinking water containing 0.3 mg/L will contribute about 0.6 mg to daily intake (Iyabu, 2020).

High levels of nitrite in water are not naturally occurring. Nitrite comes from old waste, which is caused by household waste, agricultural waste, domestic and industrial waste. Iron content in water that exceeds the limit can have negative effects such as causing odour, yellow colour in water, deposition in pipes, and causing disease (Siahaan, 2019).

In surface water, iron content greater than 1 mg/L is rarely found, but in groundwater iron content can be found with high content. High iron content can be seen in kitchen utensils and fabrics stained with brownish-red iron spots (Munthe, 2018); (Asmadi, 2018). Iron found in well water can cause skin irritation, cholera, diarrhoea, gastrointestinal disease, even to haemorrhagic necrosis and sloughing of mucosal areas in the stomach with extension into the submucosa if contacted or drunk, in addition, iron can cause respiratory system disorders such as coughing, weakness, shortness of breath, pulmonary oedema, bronchopneumonia and methemoglobinaemia and cyanosis.

Based on the Indonesian Minister of Health Regulation No. 32 Year 2017 on environmental health quality standards for water media for sanitary hygiene purposes, the maximum iron content threshold is 1.0 mg/L and based on the Indonesian Minister of Health Regulation No. 492/Menkes/Per/IV/2010 on drinking water quality standards, the allowable iron content threshold is 0.3 mg/L. The industrial area of mabar hilir pasar 3 bantenan Medan city is one of the industrial areas located among local settlements. One of the industries in the area is an oil factory that will produce one of the contaminants is iron. Pollution from the factory industry will be a problem for public health, especially in the quality of clean water in the surrounding community. From the results of preliminary studies related to physical water quality measurements on community well water, it can be seen that the average community well water is coloured, tastes and smells. From the description above, researchers are interested in conducting research on iron (Fe) content that might contaminate community well water in the area.

An environmental problem that is currently the most important discussion is the problem of water. Water is one of the most important necessities of life (Ritonga, 2018).Without water the process of life will be hampered and can even not take place. humans can survive without

food for several weeks, but cannot survive without water even a few days (Suhendar, 2017). This is stated in the Qur'an. "That We may bring to life by water the land which is dead, and that We may give drink by water to the greater part of Our creatures, the cattle and the multitude of men" (Surah Al-Furqan, 25: 49).

The existence of clean water is indeed very important in order to fulfil daily needs "Narrated Ali ibn Al Ja'dan Al Lu`lui from Hibban ibn Zaid Ash Shar'i from a man of Qarn. (Musaddad narrated to us Isa bin Yunus narrated to us Hariz bin Uthman narrated to us Abu Khidash and this is the narration of 'Ali from a Muhajirin man who was a companion of the Prophet who said: "I fought with the Prophet three times and I heard him say: "Muslims are allies in grass, water and fire."" (HR. Abu Daud).

METHODS

Research Design

This study is an observational study with a cross sectional design, which is to determine the description of iron content contained in well water using laboratory tests with the APHA 3120B method, 22nd ed.2012.

Sample Population

The population in this study were all residents' wells in the Industrial Area Jl. Mangaan 8 Lk.1 Mabar Hilir Pasar 3 Bantenan, Medan City. Samples in this study amounted to 10 well water samples. The sampling method was carried out by purposive sampling method, namely with the provision of wells used for domestic household purposes, brushing teeth, washing clothes, washing cutlery, cooking and so on.

Data collection

The tools used are 1.5L bottles, stationery, drop pipettes, label paper, latex gloves, and Spectrophotometer. Meanwhile, the materials used were concentrated HCL, concentrated HNO3, distilled water, 20% hydroxyl amine solution, ammonium acetate buffer pH 4, phenanthroline 0.1% solution, iron (Fe) standard solution, and potassium thiocyanide 2N solution.

Sampling Method

In dug wells, samples are taken at a depth of 20 cm below the water surface on oagi days. The stages of sampling in dug wells according to SNI 6989.58: 2008 for this purpose are: (1) prepare a sampling device that is in accordance with the condition of the water source, (2) rinse the tool with samples to be taken 3 times, (3) take samples as needed.

Sampling on the water faucet, the stages are as follows: (1) prepare a clean bottle free of iron, (2) open the water faucet for 1-2 minutes, (3) open the bottle cap and fill the sample 3/4 of the volume of the bottle and (4) do preservation by chemical means. Chemical preservation can be done according to SNI 6989.58: 2008, namely by adding concentrated nitric acid to the sample up to pH <2. Then send samples to BTKLPP Class 1 Medan laboratory.

RESULTS

Tabel.1 Iron (Fe) Content in Well Water of Communities Around the Mabar Hilir Industrial Estate Market 3 Bantenan Medan City

No.	Test Results (mg/L)	Quality Standards	
		Clean Water	Drinking Water
Sample 1	0,152137	1,0 mg/L	0,3 mg/L
Sample 2	0,123216	1,0 mg/L	0,3 mg/L
Sample 3	0,059712	1,0 mg/L	0,3 mg/L
Sample 4	0,125335	1,0 mg/L	0,3 mg/L
Sample 5	0,136997	1,0 mg/L	0,3 mg/L
Sample 6	0,224305	1,0 mg/L	0,3 mg/L
Sample 7	0,233506	1,0 mg/L	0,3 mg/L
Sample 8	1,913907	1,0 mg/L	0,3 mg/L
Sample 9	0,73374	1,0 mg/L	0,3 mg/L
Sample 10	0,092933	1,0 mg/L	0,3 mg/L

Source : Primary Data 2022

Based on Table 1, it can be seen that out of 10 wells, there are 2 wells that do not qualify as drinking water, namely wells 8 and 9 with the amount of iron content in the well water is 1.913907 and 0.73374 respectively (quality standard = 0.3 mg/L) and 1 well that does not qualify as clean water, namely well 8 with the amount of iron content in the well water is 1.913907 (quality standard = 1.0 mg/L). The drinking water quality standard is based on the regulation of the Indonesian Minister of Health No. 492/Menkes/Per/IV/2010 where the maximum allowable iron (Fe) content is 0.3 mg/L. Clean water quality standard based on the regulation of the Indonesian Minister of Health No. 32 Year 2017 where the maximum allowable iron (Fe) content is 1.0 mg/L.

DISCUSSION

Clean water and drinking water requirements have been regulated in the Indonesian Minister of Health Regulation. The Regulation of the Indonesian Minister of Health governing Environmental Health Quality Standards and Water Health Requirements for Sanitary Hygiene, Swimming Pools, Solus Per Aqua and Public Baths is explained in detail in the Indonesian Minister of Health Regulation No. 32 of 2017. While the RI Minister of Health

Regulation on Drinking Water Quality Requirements is detailed in the RI Minister of Health regulation No. 492/Menkes/Per/IV/2010 (Iqbal, 2019).

The quality standards for clean water and drinking water are used as guidelines or safe limits for elements contained in clean water and drinking water that are allowed to be used by the community (Hamzah, 2019); (Silviana, 2020). To get healthy and quality clean water, it is necessary to monitor clean water regularly which aims to prevent a decrease in the quality and use of water that can cause health problems (Paradila, 2021).

The results of this study indicate that 2 of the 10 wells that do not qualify as drinking water are wells 8 and 9 with the amount of iron content in the well water is 1.913907 and 0.73374 respectively (quality standard = 0.3 mg/L) and 1 well that does not qualify as clean water is well 8 with the amount of iron content in the well water is 1.913907 (quality standard = 1.0 mg/L). The presence of iron in clean water causes rust colour (colloidal red) in the water due to oxidation by dissolved oxygen, metallic odour, and can cause toxicity in humans (Asmaningrum, 2016). Iron levels greater than 1 mg/L will cause irritation to the eyes and skin. If the solubility of iron exceeds 10 mg/L in water, it will cause the water to smell like rotten eggs (Febrina, 2015); (Aronggear, 2019).

Iron content in well water can occur due to various things such as the presence of used iron waste which then seeps into the soil due to the disposal of industrial waste around settlements, then it can also be caused by shallow groundwater pollution which is influenced by surface runoff and the quality of surrounding water bodies (Fahmi, 2021); (Rivai, 2019). Based on the results of previous research, namely in the study Chemometric analysis of Fe, Mn, and Zn levels in groundwater in housing around the Candi Industrial Estate Semarang using UV-Vis spectroscopy, it was found that in general the condition of groundwater in housing around the Candi Industrial Estate meets the quality standards for groundwater quality based on Permenkes No. 32 of 2017, only in area 7 the Iron (Fe) level exceeds the threshold of 1.12g/L. The average levels of Fe metal are 0.43Mg/L, Mn 0.11Mg/L, and Zn 0.66Mg/L (Zulhilmi, 2019); (Wahyu, 2017); (Andini, 2017).

In Islam there is a prohibition on using water that is located in iron vessels or cans and then the water is exposed to direct sunlight. Actually, this prohibition only reaches the makruh level, not the haram level. However, we can see the reasons and effects of the prohibition of using this water. The scholars of fiqh explain the consequences of using this type of water is that it can damage the skin and water that damages the skin is due to water exposed to the sun and iron objects will have iron which can damage the function of human organs. Therefore it is also explained in the hadith "From Urwah from Aisha she said: The Messenger of Allah

(saw) forbade making ablution using musyammas water (sun-dried in metal or iron containers) or using that water for bathing, the Apostle said: it can cause leprosy (Abu Al Hasan Dar Al Quthni, 2004)".

The impurity of this water is due to the fact that water that is exposed to the sun in a metal or iron container will make the iron substances in the container mix with the water and will cause disease. Therefore, the reason for the prohibition of using water is explained by the scholars. This prohibition is not based on Sharīʿah, but rather on medical grounds, because the water does not prevent wudhuʿ or bathing from being valid, unlike when the prohibition is based on too much heat, which is based on Sharīʿah. The difference between these two reasons is that refraining from using musyammas water on shara' grounds will be rewarded, while refraining from using musyammas water on medical grounds will not be rewarded (Islamiyah, 2006).

Regarding the reason for the prohibition of using this water, it is reinforced by the conditions put forward by the fuqaha' (fiqh scholars) for the water to be dangerous to use (Qalyuby, 1995); Being in a place with hot weather. Such as Mecca, Medina and so on. The water is in a container that has metal elements other than gold and silver, such as iron or copper; The water is directly exposed to the sun, which causes the water to change its concentration, because substances derived from metal and iron rust have appeared and mixed with the water; The water is used when the conditions are hot; In this one place there can still be found water used for purification other than the musyammas water; The prayer time is still loose, so it still gives time for people to look for and find other water.

CONCLUSIONS

The results of research conducted on 10 well water samples in the Mabar Hilir Industrial Area, Market 3 Bantenan, Medan City, North Sumatra found 1 out of 10 well water samples containing iron over the maximum level set by Permenkes No. 32 of 2017 concerning Environmental Health Quality Standards and Water Health Requirements for Sanitary Hygiene Purposes, Swimming Pools, Solus Per Aqua, and Public Baths, namely 1.913907 mg/L (quality standard = 1.0 mg/L) in well water sample no. 8. And 2 out of 10 well water samples were found to contain iron exceeding the maximum level set by Permenkes RI No. 492/Menkes/IV/2010 concerning Drinking Water Quality Requirements, namely 1.913907 and 0.73374 (quality standard = 0.3 mg/L) in samples no. 8 and 9, respectively. This proves that there is iron content that exceeds the standard in the well water of residents in the industrial area.

REFERENCE

Abu Al Hasan Dar Al Quthni. (2004). *Hadis ke-87 (Muassasah Al Risalah)* (Cetakan 1). Muassasah Al Risalah.

Andini, A. (2017). Analisa Kadar Kromium VI [Cr (VI)] Air Di Kecamatan Tanggulangin Sidoarjo. *Jurnal Sainhealth*, *1*(2), 55–58.

Aronggear, T. E. (2019). Analisis Kualitas dan Kuantitas Penggunaan Air Bersih PT. Air Manado Kecamatan Wenang. *Jurnal Sipil Statik*, *7*(12), 1625–1635.

Asmadi. (2018). Pengurangan chrom (Cr) Dalam Limbah Cair Industri Kulit Pada Proses Tannery Menggunakan Senyawa Alkali Ca(OH)2, NaOH dan NaHCO3 (Studi Kasus PT. Trimulyo Kencana Mas Semarang). *Jurnal Air Indonesia*, *5*(1), 41–54.

Asmaningrum, H. P. (2016). Penentuan Kadar Besi (Fe) dan Kesadahan pada Air Minum Isi Ulang di Distrik Merauke. *Jurnal Magistra.*, *3*(2), 95–103.

Earnestly, F. (2022). Analisa pH, Fe, Mn Pada Sumber Air Panti Asuhan Aisyiyah Koto Tangah. *Jurnal Katalisator*, *7*(1), 29–40.

Fadhilla, A. (2022). Analisis Kadar Logam Besi (Fe) pada Depot Air Minum Isi Ulang di Kota Lhokseumawe. *COMSERVA: Jurnal Penelitian Dan Pengabdian Masyarakat*, *1*(12), 1–12. https://doi.org/https://doi.org/10.59141/comserva.v1i12.182

Fahmi, M. A. (2021). Analisis Laju Infiltrasi Tanah Dangkal pada Sub-Das Pelangan Kabupaten Lombok Barat. *Jurnal Handasah (Jurnal Ilm Tek Sipil)*, *1*(2), 6–12.

Fatma, F. (2022). Analisis Perbedaan Kadar Besi (FE) Menggunakan Serbuk Cangkang Telur Pada Air Sumur Gali. *Human Care Journal*, *7*(2), 430–441. https://doi.org/http://dx.doi.org/10.32883/hcj.v7i2.1731

Febrina, L. (2015). Studi Penurunan Kadar Besi (Fe) dan Mangan (Mn) dalam Air Tanah Menggunakan Saringan Keramik. *Jurnal Teknologi*, *7*(1), 19-22.

Ghosh, G. C. (2020). Human Health Risk Assessment of Elevated and Variable Iron and Manganese Intake with Arsenic-Safe Groundwater in Jashore, Bangladesh. *Scientific Reports*, *10*(1), 5206–5220. https://doi.org/https://doi.org/10.1038/s41598-020-62187-5

Hamzah, H. (2019). Analisis Kandungan Zat besi (Fe) Pada Daun Kelor (Moringa oleifera Lam.) Yang Tumbuh dengan Ketinggian Berbeda di Daerah Kota Baubau. *Indo. J. Chem. Res.*, *6*(1), 88-93. https://doi.org/https://doi.org/10.30598//ijcr.2019.6-has

Iqbal, M. (2019). Pembinaan Dan Pengawasan Dinas Kesehatan Terhadap Kualitas Depot Air Minum Isi Ulang Di Kabupaten Simeulue Tahun 2018. *Contagion : Scientific Periodical of Public Health and Coastal Health*, *1*(1), 1–10. https://doi.org/http://dx.doi.org/10.30829/contagion.v1i01.4424

Islamiyah. (2006). *Al Mausu'ah Alfiqhhyah Al Kuwaitiyah*. Dar Al Salasil.

Iyabu, H. (2020). Iron in Well Water : Case Study in Dulalowo and Heledulaa Districts. *Jambura Journal of Chemistr*, *2*(2), 46–52. https://doi.org/https://doi.org/10.34312/jambchem.v2i2.6990

Munthe, S. A. (2018). Analisa Penurunan Kadar Besi (Fe) dengan Metode Waterfa;; Aerator dan Multiple. *J. Mutiara Kesehatan Masyarakat*, *3*(2), 125-135.

Paradila, A. W. (2021). Penentuan Kandungan Nitrit, Besi, Kromium dan Kekeruhan dalam Air Bersih Kapal. *Amina*, *3*(2), 44–49. https://doi.org/https://doi.org/10.22373/amina.v3i2.1996

Qalyuby, A. S. Al. (1995). *Hasyiyata Al Qaliyubi Wa Umairoh*. Dar El Fikr.

Ritonga, M. (2018). Modulisasi Kitab Kuning Bidang Fiqh Berbasis Materi Uam Di Pondok Pesantren Darul Ulum Air Pacah. *Jurnal Kajian Dan Pengembangan Umat*, *1*(1), 1–13. https://doi.org/https://doi.org/10.31869/jkpu.v1i1.1115

Rivai, A. (2019). Hubungan Kandungan Nitrat (NO3) Dan Nitrit (No2) Pada Air Lindi Dengan Kualitas Air Sumur Gali Di Kel.Bangkala Kec.Manggala Kota Makassar Tahun 2017. *Sulolipu: Media Komunikasi Sivitas Akademika Dan Masyarakat.*, *17*(2), 1-10. https://doi.org/https://doi.org/10.32382/sulolipu.v17i2.791

Siahaan, M. A. (2019). Analisis kadar besi (Fe) pada air sumur gali pendududuk wilayah kompleks Rahayu Kelurahan Mabar Hilir Kecamatan Medan Deli Kota Medan. *Jurnal Kimia Saintek Dan Pendidikan*, *3*(1), 19–22.

Sibarani, S. T. (2022). Pengaruh Suhu dan Jenis Aktivator Pada Karbon Aktif Limbah Daun Nanas terhadap Kadar Besi (Fe) Dan Mangan (Mn) Air Sumur. *Jurnal Teknologi Lingkungan*, *6*(2), 33-42.

Silviana, E. (2020). Analisis Logam Besi (Fe) Dalam Air PDAM Di Kabupaten Pidie Jaya Menggunakan Spektrofotometer Serapan Atom. *The Journal Serambi Engineering (JSE)*, *5*(3), 1–10. https://doi.org/https://doi.org/10.32672/jse.v5i3.2142

Suhendar, D. (2017). Fikih (Fiqh) Air Dan Tanah Dalam Taharah (Thaharah) Menurut Perspektif Ilmu Kimia. *Jurnal Istek*, *10*(1), 170–193.

Suryani, M. Y. (2022). Analisis Penentuan Kadar Besi (Fe) dalam Air Limbah Tambang Batu Bara Menggunakan Spektrofotometer UV-Vis. *Indonesian Journal of Laboratory*, *5*(1), 1–10. https://doi.org/https://doi.org/10.22146/ijl.v0i0.72451

Wahyu, R. (2017). Kandungan Logam Berat Kadmium (Cd) dan Kromium (Cr) di Air Permukaan dan Sedimen: Studi Kasus Waduk Saguling Jawa Barat . *Institut Teknologi Nasional Oktober*, *5*(2), 1–12.

Wollschläger. (2018). Reactive molecular beam epitaxy of iron oxide films: Strain, order, and interface properties. *Encyclopedia of Interfacial Chemistry: Surface Science and Electrochemistry*, *1*(1), 284–296. https://doi.org/https://doi.org/10.1016/B978-0-12-409547-2.14173-3

Yiannikourides, A. (2019). A Short Review of Iron Metabolism and Pathophysiology of Iron Disorders. *Medicines*, *6*(3), 85–95. https://doi.org/https://doi.org/10.3390/medicines6030085

Zulhilmi, E. (2019). Faktor yang Berhubungan Tingkat Konsumsi Air Bersih pada Rumah Tangga di Kecamatan Peudada Kabupaten Bireun. *Jurnal Biologi Education*, *7*(2), 110–126.